IPS Academy

INSTITUTE OF ENGINEERING & SCIENCE

Knowledge, skills and values

MECHAZINE

Department of Mechanical Engineering

Annual Magazine

2017-18

Letter from the Editors

Dear Readers,

It gives us immense pleasure to present the third issue of ***Mechazine*** e-magazine of the Department of Mechanical Engineering. It is the talent and outlook of our students which is portrayed through this magazine. This is one of the best platforms for our students to present multifaceted personalities and innovative ideas. It also enables the students to be aware of their changing surroundings and to consistently learn about new technologies.

We take this opportunity to thank our respected Principal **Dr. Archana Keerti Chowdhary,** HOD **Dr. Sanjay Jain** and all the faculty members for their incessant inspiration and kind support.

We hope that this edition would be enjoyable as well as informative.

Editors…

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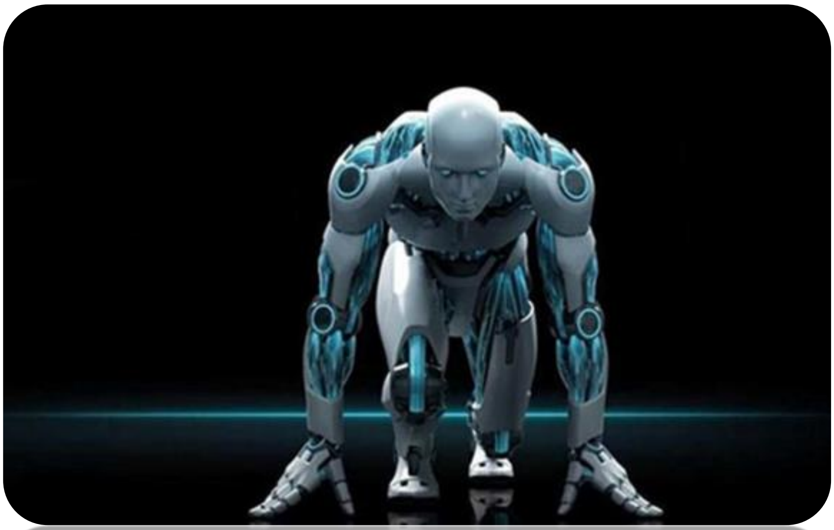
STUDENT ARTICLES



Turbofan Engine

A turbofan engine is the most modern variation of the basic gas turbine engine. Turbofans were excogitated to eliminate the drawback of turbojets, which was that they were inefficient for subsonic flight (a subsonic flight is the flight of an aircraft at a speed less than or equal to that of sound in air). To raise the efficiency of a turbojet, the obvious approach would be to increase the burner temperature, fit larger compressors and nozzles and to give better Carnot efficiency but it has its own drawbacks. To move an airplane through the air, thrust is generated by some kind of propulsion system. Turbofan engines are widely used by most airliners because of their high thrust and good fuel efficiency.

Construction:

At the front of the engine, to the left, is the inlet. At the exit of the inlet is the compressor. The compressor is connected by a shaft to the turbine. The compressor and the turbine are composed of many rows of small airfoil shaped blades. Some rows are connected to the inner shaft and rotate at high speed, while other rows remain stationary. The rows that spin are called rotors and the fixed rows are called stators. The combination of the shaft, compressor and turbine is called the 'turbo machinery'. Between the compressor and the turbine flow path is the combustion section or burner. This is where the fuel and the air are blended and burned. The hot exhaust then passes through the turbine and out of the nozzle. The nozzle performs two important tasks. The nozzle is shaped to accelerate the hot exhaust gas to produce thrust and the nozzle sets the mass flow through the engine.

Bypass ratio and Thrust:

Bypass ratio-

The bypass ratio (BPR) of a turbofan engine is the ratio between the mass flow rate of the bypass stream to the mass flow rate entering the core. A 20:1 bypass ratio, for example, means that 20 kg of air passes through the bypass duct for every 1 kg of air passing through the core.

Turbofan engines are usually described in terms of BPR, which together with overall pressure ratio, turbine inlet temperature and fan pressure ratio are important design parameters. In addition BPR is quoted for turboprop and inducted fan installations because their high propulsive efficiency gives them the overall efficiency characteristics of very high bypass turbofans. This allows them to be shown together with turbofans on plots which show trends of reducing TSFC (thrust-specific fuel consumption) with increasing BPR. BPR is also quoted for lift fan installations where the fan airflow is remote from the engine and doesn't physically touch the engine core.

Thrust-

While a turbojet engine uses all of the engine's output to produce thrust in the form of a hot high velocity exhaust gas jet, a turbofan's cool low velocity by pass air yields between 30% and 70% of the total thrust produced by a turbofan system.

Mathematical expression:

The thrust (FN) generated by a turbofan depends on the effective exhaust velocity of the total exhaust, as with any jet engine, but because two exhaust jets are present the thrust equation can be expanded as:

$$FN = \dot{m}_e v_{he} - \dot{m}_o v_o + BPR(\dot{m}_c v_f)$$

where:

$\dot{m}_e$= the mass rate of hot combustion exhaust flow from the core engine

$\dot{m}_o$ = the mass rate of total air flow entering the turbofan = $\dot{m}_c + \dot{m}_f$

$\dot{m}_c$= the mass rate of intake air that flows to the core engine

$\dot{m}_f$= the mass rate of intake air that bypasses the core engine

v_f= the velocity of the air flow bypassed around the core engine

v_{he}= the velocity of the hot exhaust gas from the core engine

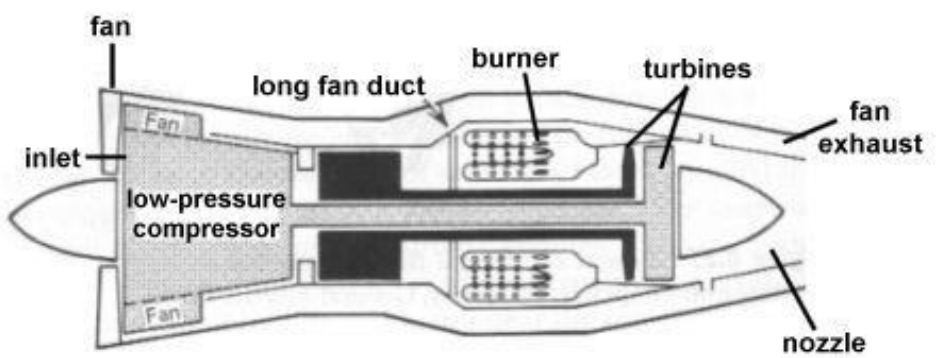
v_o= the velocity of the total air intake = the true airspeed of the aircraft

BPR= Bypass Ratio

Common types of turbofans:

Low-bypass turbofan-

A high-specific-thrust low-bypass-ratio turbofan normally has a multi-stage fan, developing a relatively high pressure ratio



Low-Bypass Turbofan

and, thus, yielding a high (mixed or cold) exhaust velocity. The core airflow needs to be large enough to give sufficient core power to drive the fan. A smaller core flow/higher bypass ratio cycle can be achieved by raising the high pressure (HP) turbine rotor inlet temperature.

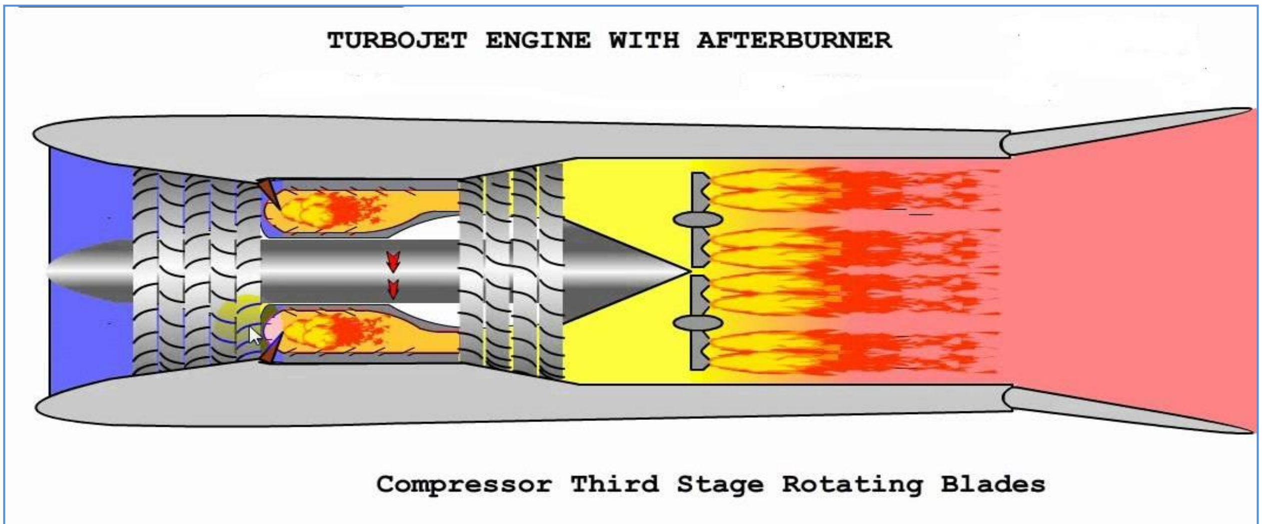
Application- Military aircrafts use low bypass engines their priorities are different. While it is true that the high bypass turbofans have better fuel economy (in cruise) and are less noisy, the low bypass engines offer significant advantages when we take into account their intended use in combat aircraft, such as: They have less frontal area, reducing the drag produced. For aircraft expected to fly at supersonic speeds, however briefly, this is important.

Afterburning turbofan-

An afterburner is a combustor located downstream of the turbine blades and directly upstream of the nozzle, which burns fuel from afterburner-specific fuel injectors. When lit, prodigious amounts of fuel are burnt in the afterburner, raising the temperature of exhaust gases by a significant degree, resulting in a higher exhaust velocity/engine specific thrust. The variable geometry nozzle must open to a larger throat area to accommodate the extra volume flow when the afterburner is lit. Afterburning is often designed to give a significant thrust boost for takeoff, transonic acceleration and combat maneuvers, but is very fuel intensive. Consequently, afterburning can be used only for short portions of a mission.

Application-

Afterburners are only used on supersonic aircraft like fighter planes and the Concorde supersonic airliner. (The Concorde turns the afterburners off once it gets into cruise. Otherwise, it would run



out of fuel before reaching Europe.) Afterburners offer a mechanically simple way to augment thrust and are used on both turbojets and turbofans.

High-bypass turbofan-

To boost fuel economy and reduce noise, almost all of today's jet airliners and most military transport aircraft (e.g., the C-17) are powered by low-specific-thrust/high-bypass-ratio turbofans. These engines evolved from the high-specific thrust/ low-bypass-ratio turbofans used in such aircraft in the 1960s. (Modern combat aircraft tend to use low-bypass ratio turbofans, and some military transport aircraft use turboprops.)

Application-

It all started with the earliest jet engines, when bypass ratios of 0.3:1 were tried out in the 1960s. With the Boeing 747 and equivalent class of aircraft came turbofans with a bypass ratio of 5:1. Modern commercial fan engines have huge bypass ratios: up to 12:1, and this means more than 80% of the engine thrust comes from the fan.

Turbofan configurations:

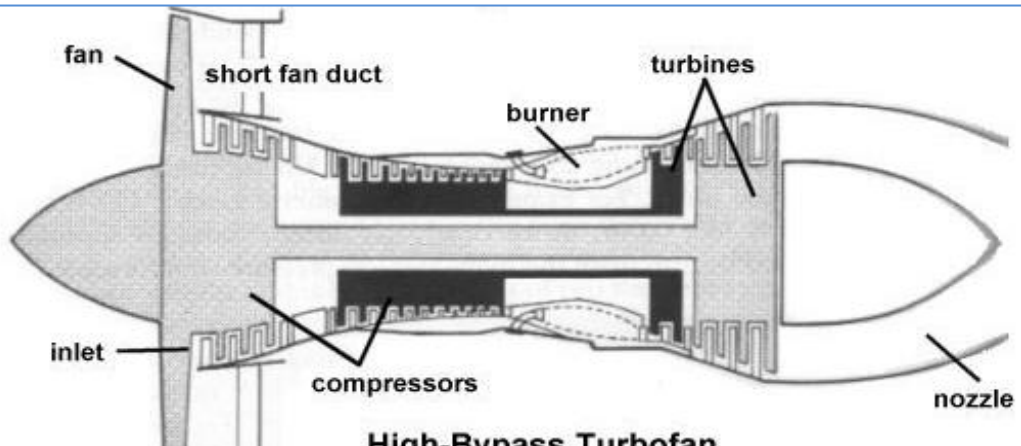
Turbofan engines come in a variety of engine configurations. For a given engine cycle (i.e., fan pressure ratio, same airflow, bypass ratio, overall pressure ratio and HP turbine rotor inlet temperature), the choice of turbofan configuration has little impact upon the design point performance (e.g., net thrust, SFC), as long as overall component performance is maintained. Off-design performance and stability is, however, affected by engine configuration.

1. Single-shaft turbofan.

2. Aft-fan turbofan.

3. Basic two-spool.

4. Boosted two-spool.



High-Bypass Turbofan

5. Three-spool.

6. Geared fan.

7. Military turbofans.

8. High-pressure turbine.

9. Low-pressure turbine.

The Future:

Engine cores are shrinking as they are operating at higher pressure ratios and becoming more efficient, and become smaller compared to the fan as bypass ratios increase. Blade tip clearances are harder to maintain at the exit of the high-pressure compressor where blades are 0.5 in (13 mm) high or less, backbone bending further affects clearance control as the core is proportionately longer and thinner and the fan to low-pressure turbine driveshaft is in constrained space within the core.

The weight and size of the nacelle would be reduced by a short duct inlet, imposing higher aerodynamic turning loads on the blades and leaving less space for soundproofing, but a lower-pressure-ratio fan is slower. UTC Aerospace Systems Aero structures will have a full-scale ground test in 2019 of its low-drag Integrated Propulsion System with a thrust reverser, improving fuel burn and reducing noise.

Shubham Gupta (IV Year)

Hydrogen: Future's Fuel

Hydrogen is one of the most abundant and promising fuel source available in the air. It is lighter than air and incredibly pure, when used in the fuel cell it is highly efficient and leaves no carbon emission behind, .and best of air it is virtually everywhere. It is found everywhere in the plants, water, manure etc. But the Problem arises before it can be used it has to be separated.

There are a lot of ways to produce hydrogen:-

I. Steam reforming:

Steam reforming of methane Is the most common method for the hydrogen production. It combines methane with the high temperature steam to trigger a reaction and separate the hydrogen. At high temperatures (700 – 1100 °C) and in the presence of a metal-based catalyst (nickel), steam reacts with methane to yield carbon monoxide and hydrogen.

$$CH4 + H2O \rightleftharpoons CO + 3\ H2$$

II. Gasification:

Gasification is a process that converts organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures

(>700 °C), without combustion, with a controlled amount of oxygen and/or steam.

III. Electrolysis:

Hydrogen can also be produced by separating water into its two primary elements—hydrogen (H2) and oxygen (O2). This process, known as electrolysis, passes an electrical current through the water to extract hydrogen. The electricity can be sourced from clean, renewable energy such as wind, solar, or hydro.

$2\ NaCl + 2\ H_2O \rightarrow 2\ NaOH + H_2 + Cl_2$

FCV concept (using hydrogen):

One such FCV (Fuel Cell Vehicle) concept car is Toyota mirai. The unveiled FCV concept was a bright blue sedan shaped like a drop of water "to emphasize that water is the only substance that hydrogen-powered cars emit from their tailpipes. The FCV uses Toyota's proprietary, small, light-weight fuel cell stack and two 70 MPa high-pressure hydrogen tanks placed beneath the specially designed body. The Toyota FCV concept can accommodate up to four occupants.

The FCV concept also uses portions of Toyota's Hybrid Synergy Drive technology including the electric motor, power control unit and other parts and components from its hybrid vehicles to improve reliability and minimize cost. The hybrid technology is also used to work together with the fuel cell. At low speeds such as city driving, the FCV runs just like any all-electric car by using the energy stored in its battery, which is charged through regenerative braking. At higher speeds, the hydrogen fuel cell alone powers the electric motor. When more power is needed, for example during sudden acceleration, the battery supports the fuel cell system as both work together to provide propulsion

High-pressure hydrogen tanks

The Mirai has two hydrogen tanks with a three-layer structure made of carbon fiber-reinforced plastic consisting of nylon 6 from Ube Industries and other materials.

The tanks store hydrogen at 70 MPa (10,000 psi). The tanks have a combined weight 87.5 kg (193 lb) and 5 kg capacity.

Safety features:

1. multi-patented, carbon-fiber-wrapped, polymerlined tanks are built in a three-layer structure and absorb five times the crash energy of steel.

2. In a high-speed collision, sensors stop the flow of hydrogen.

3. Any leaked hydrogen is quickly dispersed. Since the gas is lighter than air,

it rapidly disperses, reducing the time window to cause damage in the event of an ignition.

Thus with the help of scientific studies and curious minds if we can create and store this hydrogen easily then it would be revolution in the field of technology. As we would get efficient and pollution free energy for the future. Thus encouraging the concept of sustainable development.

Madhvi Bairagi (II Year)

Details of 8 Hottest Emerging Segment of Engineering

In the past one decade, not only the number of engineering graduates has increased phenomenally, but also the advent of fields and sectors to work in, thanks to the tech boom! For aspirants who manage not to fit in the box and love to work out of it, here's a list of eight hot jobs that will help them break into the new fields of engineering, as per a website:

New job opportunities for Mechanical engineers

- *Artificial Intelligence, Robotics & Mechatronics ;*
- *Quality Assurance, Six Sigma & Lean Manufacturing ;*
- *Simulation , Modeling and Experimental Research ;*
- *Advance Production Engg. & Automation ;*
- *Supply Chain Management;*
- *Environmental & Sustainability issues;*
- *Composite Materials ;*
- *Application of Nanotechnology ;*
- *Recent Advances in Automobile Engineering;*
- *Renewable Energy Technology ;*
- *Globalization issues in Production & Energy Management ;*
- *CAD/CAM ;*
- *Computational Fluid Mechanics and Heat Transfer ;*
- *Refrigeration & Air-conditioning ;*
- *Professional Ethics & Intellectual Property;*

3D Printing: With some of the biggest industries in India already applying it for design visualization and optimization, 3D printing is a revolutionary technology that is sprawling in almost all modern work fields. The most important feature of this profession is that it enables manufacturing to be closer to its markets and customers and one doesn't need huge factories with manufacturing setups.

Even the traditional Indian jeweller houses have started deploying it for making ornaments with complex design patterns.

Energy systems: Energy Systems Engineering is a multidisciplinary programme that aims to meet the current and growing challenge of declining fossil fuel resources and the demand for alternative, renewable energy sources as a whole. The energy system program covers engineering knowledge and skills in areas such as energy generation, conversion, electrical power systems and energy management. It also enables individuals in understanding of the global and local impact of energy conversion, distribution in a system to influence public policy decisions in the long run.

UAV developments: An unmanned aerial vehicle commonly known as a drone is growing is huge popularity with some of the top online companies for the quick delivery of the ordered goods to the customers. And due to this adverse effect, jobs and careers in UAV domain continue to grow.

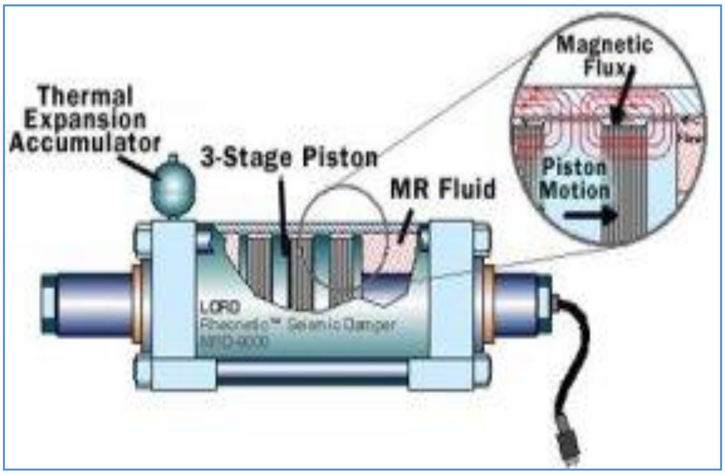
UAV applications are used in various missions and some of them include the aerial imagery for civil and military purposes, counter operations during terrorist attacks, environmental studies, surveillance of disaster-prone areas and many other functions where in-depth operations are necessary.

Advanced Materials: The field of advanced materials originally germinates from the research offerings in physics and chemistry. The domain essentially involves characterization, synthesis and processing of advanced materials to understand their original properties. This advanced materials engineering decisively work on high-end research equipment like, Nuclear magnetic resonance (NMR) and Transmission electron microscopy (TEM) which is applicable in the healthcare industry. Even though it's a niche course some of the leading world universities offer postgraduate courses in advanced materials for chemical engineers and others.

Fuel Cells: Fuel cell is one of the emerging specialized fields of chemical engineering, which converts the chemical energy from a fuel into electricity through a chemical reaction with oxygen or another oxidizing agent. The emerging fuel cells engineering is most often directed at making variants that consume less power at extreme conditions and deliver the maximum output of temperature by using new-age materials. Engineers who are looking to take this as a career option are most probably recruited at energy and automobile companies.

Nanotech: Nanotechnology engineering is a multi-specialized engineering field which simultaneously draws benefits in areas such as materials science, engineering, chemistry, physics, and biology. Indeed, it is all about generating new technology by unleashing the potential of materials at nanoscale. A degree in the field of nanotechnology will give engineers a practical education in key areas of nanotechnology that include the fundamental chemistry, physics, engineering of nanostructures as well as the theories and techniques used to model, design, fabricate, or characterize these technologies.

Robotics: If not now, we all know that robots will play a greater part in providing services than what they do today. In fact creating robots might continue to be expensive and some high-end models might cost as much as an economy car but that doesn't stop individuals from seizing the opportunity the profession has to offer in future. The coming together of electrical, computer and mechanical engineering principles has created a strong foundation for engineering in robotics. To justify that surgeries in healthcare are now assisted by robotic equipment for accuracy, invasiveness and high efficiency.



Simulation Tools: Simulation technology is an engineering concept which enables replication of the phenomenon based on certain mathematical formulas and programmes. Simulation software is widely used design equipment so that the final product will be as close to design specs without expensive in process modification.

Engineers who are thinking of a career in simulation engineering could be a great bet because there is in an array of industries they can choose from that includes the healthcare, gaming, manufacturing, transportation and automobile.

Nikhil Bobde (III Year)

Smart damping

Today, a large number of automobiles manufacturers rely on many different types of the control systems when it comes to the performance optimization. The ride quality, driving pleasure and the driving comfort are important parameters that design engineers keep in mind while designing an automobile. The main issue that hampers the performance of an automobile is vibration. The vibrations that originate in an automobile are due to the road unevenness, the aerodynamic forces and the vibrations that are induced due to the engine. A suspension system is provided in every automobile for vibration suppression. A conventional suspension system consists of a spring-type element placed parallel in a viscous fluid. The damping action is carried out by forcing the viscous fluid through a small orifice and the damping action depends on the viscosity of the fluid and on the geometry of the orifice and the damper. The fluids in these dampers are non-adaptive and can't change their rheological properties on varying conditions. The built-in drawbacks of these classical suspension systems are overcome by Magneto-Rheological dampers.

A Magneto-Rheological (MR) damper comprises of a piston and electromagnet fitted in a cylinder filled with MR fluid. MR fluids are smart fluids that change their rheological properties under the application of magnetic field and turn from liquid to solid in just fraction of seconds. They are the suspensions of micron sized, magnetizable particles suspended in an appropriate carrier liquid such as mineral oil, synthetic oil, water or ethylene glycol. When a current is passed through the electromagnet present in the damper, a magnetic field is developed. Under influence of magnetic field, the suspended magnetic particles interact to form a chain like structure that resists shear deformation or flow leading to a change in viscosity. The effect is immediately reversible if the magnetic field is reduced or removed and hence by controlling the amount of current through the electromagnet, damping rate of the damper can be changed.

The MR technology has been developing competitively because of its advantages such as mechanical simplicity, high dynamic range, low power requirements, large force capacity and robustness. While it offers a compromise solution for the two conflicting requirements of ride comfort and vehicle handling, magnetic particle sedimentation and heavy weight of dampers still remains a problem. The challenge ahead lies in developing the Magneto-rheological damper at industrial level in more controlled way.

Satyanarayan Dwivedi (IV Year)

Additive Manufacturing: The Green Manufacturing Technology

Today, Additive Manufacturing (AM) is defined as the manufacturing process to build three dimensional objects by adding layer-upon-layer of material. The process starts with a computer-aided-design (CAD) file that includes information about how the finished product is supposed to look. The material can be plastic, metal, concrete or even human tissue. AM is achieved using an additive process, where successive layers of material are laid down in different shapes. It is also considered different from traditional machining techniques that mostly depend on the removal of material by subtractive processes like milling or lathing. It emerged as an environmentally friendly green manufacturing technology which brings great benefits, such as energy saving, less material consumption, and efficient production.

All AM technologies involve a series of steps that move from the virtual three dimensional geometric representations to the physical resultant part. Due to variety of the product demands and the level of complexity, AM involves in process development in different ways and different degrees. Furthermore, in the early stages of product development of small and relatively simple products AM is used for a simple fabrication of visualization model while in later stages the larger and more complex parts require certain technology and possible post processing activities for the final form of the product. Regardless the case, the construction process of all AM technologies follows to some degree at least the same principle generic process sequence. Following eight key steps can be defined as the generic process of AM:

1. Conceptualization and CAD
2. Conversion to STL
3. Transfer and manipulation of STL file on AM machine
4. Machine setup
5. Build
6. Part removal
7. Post processing of part
8. Application

Mansi Pare (II Year)

Crack Initiation Angle In Fracture Mechanics

Fracture mechanics is the field of mechanics concerned with the study of the propagation of cracks in materials. It uses methods of analytical solid mechanics to calculate the driving force on a crack and those of experimental solid mechanics to characterize the material's resistance to fracture.

In modern materials science, fracture mechanics is an important tool used to improve the performance of mechanical components. It applies the physics of stress and strain behavior of materials, in particular the theories of elasticity and plasticity, to the microscopic crystallographic defects found in real materials in order to predict the macroscopic mechanical behavior of those bodies. Fractography is widely used with fracture mechanics to understand the causes of failures and also verify the theoretical failure predictions with real life failures. The prediction of crack growth is at the heart of the damage tolerance mechanical design discipline.

The research on the mixed fracture criterion and crack growth is significant in fracture mechanics and engineering. Many research works in this area have been conducted and some criteria for predicating the direction of the crack initiation angle have been determined. Thus, studying crack initiation angles is an important issue in dealing with crack arrest.

Due to the modern developments in the computations, researchers around the world are working to simulate the crack propagation and one of the key issues in predicting crack propagation path is the value of the crack initiation angle. Because crack propagation concept is highly dependent on the state of stress in the vicinity of the crack tip, stress intensity factor (SIF) is considered as the most important parameter that can be used to predict the crack propagation.

Fracture is a form of failure, and is defined as the separation or fragmentation of a solid body into two or more parts under the action of stress. Fracture that occurs over a very short time period and under simple loading conditions (static i.e. constant or slowly changing) is considered here. The process of fracture can be considered to be made up of two components, crack initiation followed by crack propagation. Fractures are classified *w.r.t.* several characteristics, for example, strain to fracture, crystallographic mode of fracture, appearance of fracture, different modes of fracture.

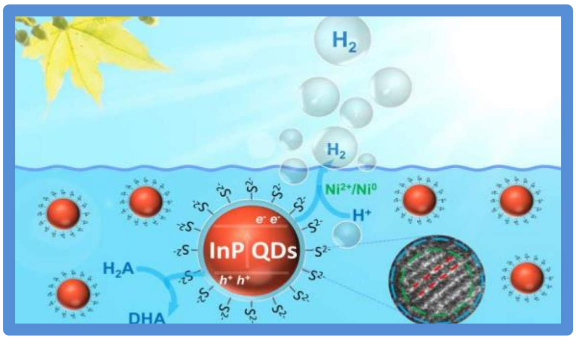
Crack initiation is related to the stress-strain hysteresis loop. The area within this loop is the dissipated energy that promotes crack initiation and propagation. While each cycle represents an infinitesimally small amount of energy, when this process is repeated over and over again, the total energy can be quite significant.

Varun Agrawal (IV Year)

Eco-friendly Nanoparticles for Artificial Photo Synthesis

Researchers at the University of Zurich have developed a type of nanoparticle by adding zinc sulfide to the surface of indium-based quantum dots. These quantum dots produce clean hydrogen fuel from water and sunlight—a sustainable source of energy. They introduce new eco-friendly and powerful materials to solar photocatalysis.

Quantum dots are true all-rounders. These material structures, which are only a few nanometers in size, display a similar behavior to that of molecules or atoms, and their form, size and number of electrons can be modulated systematically. This means that their electrical and optical characteristics can be customized for a number of target areas, such as new display technologies, biomedical applications as well as photovoltaic's and photo catalysis.



Another current line of application-oriented research aims to generate hydrogen directly from water and solar light. Hydrogen, a clean and efficient energy source, can be converted into forms of fuel that are used widely, including methanol and gasoline. The most promising types of quantum dots previously used in energy research contain cadmium, which has been banned from many products due to its toxicity.

The team of Professor Greta Patzke of the University of Zurich and scientists from Southwest Petroleum University in Chengdu and the Chinese Academy of Sciences has now developed a new type of nonmaterial for photo catalysis without toxic components.

The three-nanometer particles consist of a core of indium phosphide with a very thin surrounding layer of zinc sulfide and sulfide ligands. "Compared to the quantum dots that contain cadmium, the new composites are not only environmentally friendly, but also highly efficient when it comes to producing hydrogen from light and water," explains Greta Patzke. Sulfide ligands on the quantum dot surface were found to facilitate the crucial steps involved in light-driven chemical reactions, namely the efficient separation of charge carriers and their rapid transfer to the nanoparticle surface.

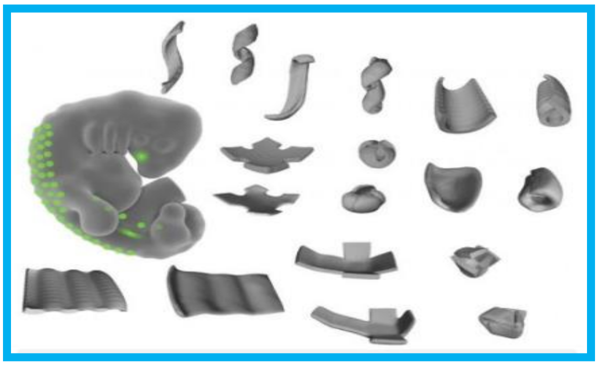
Anshul Vishwakarma (II Year)

Engineers hack cell biology to create 3-D shapes from living tissue

Many of the complex folded shapes that form mammalian tissues can be recreated with very simple instructions, UC San Francisco bioengineers report December 28 in the journal *Developmental Cell*. By patterning mechanically active mouse or human cells to thin layers of extracellular matrix fibers, the researchers could create bowls, coils, and ripples out of living tissue. The cells collaborated mechanically through a web of these fibers to fold themselves up in predictable ways, mimicking natural developmental processes.

Labs already use 3D printing or micro-molding to create 3D shapes for tissue engineering, but the final product often misses key structural features of tissues that grow according developmental programs. The Gartner lab's approach uses a precision 3D cell-patterning technology called DNA-programmed assembly of cells (DPAC) to set up an initial spatial template of a tissue that then folds itself into complex shapes in ways that replicate how tissues assemble themselves hierarchically during development.

"We're beginning to see that it's possible to break down natural developmental processes into engineering principles that we can then repurpose to build and understand tissues," says first author Alex Hughes, a postdoctoral fellow at UCSF. "It's a totally new angle in tissue engineering."



‘‘This image shows the shape made by living tissue made by the researchers. By patterning mechanically active mouse or human cells to thin layers of extracellular fibers, the researches could create bowls, coils, and ripple shapes’’.

Roshan Patil (III Year)

Mighty Morphing Materials Take Complex Shapes

Scientists have created a liquid crystal elastomer that can be molded into shapes that shift from one to another when heated. The material is intended for biomedical and robotics applications.

A face made of a unique polymer at Rice University takes shape when cooled and flattens when heated. The material may be useful in the creation of soft robots and for biomedical applications.

The shapes programmed into a polymer by materials scientist Rafael Verduzco and graduate student Morgan Barnes appear in ambient conditions and melt away when heat is applied. The process also works in reverse. The smooth operation belies a battle at the nanoscale, where liquid crystals and the elastomer in which they're embedded fight for control. When cool, the shape programmed into the liquid crystals dominates, but when heated, the crystals relax within the rubber band-like elastomer, like ice melting into water.

In most of the samples Barnes has made so far -- including a face, a Rice logo, a Lego block and a rose the material takes on its complex shape at room temperature, but when heated to a transition temperature of about 80 degrees Celsius (176 degrees Fahrenheit), it collapses into a flat sheet. When the heat is removed, the shapes pop back up within a couple of minutes.

The research is described in the Royal Society of Chemistry journal *Soft Matter*."These are made with two-step chemistry that has been done for a long time," said Verduzco, a professor of chemical and biomolecular engineering and of materials science and nanoengineering. "People have focused on patterning liquid crystals, but they hadn't thought about how these two networks interact with each other.

"We thought if we could optimize the balance between the networks -- make them not too stiff and not too soft -- we could get these sophisticated shape changes."

The liquid crystal state is easiest to program, he said. Once the material is given shape in a mold, five minutes of curing under ultraviolet light sets the crystalline order. Barnes also made samples that switch between two shapes.

Kailash Sahu (II Year)

ISHRAE CHAPTER

CHAPTER INSTALLATION
SESSION2017 – 18 @ 28/07/2017

The chapter was installed in IES IPS Academy in the month of August 2017 followed by a Technical talk given by the President of ISHRAE Indore chapter Mr. Pankaj Tiwari Sir working as an MEP Consultant, Indore on “Building Management System” to the student members registered as an ISHRAE Members with the oath ceremony of the CWC members.

Oath Ceremony

Technical Talk by Mr. Pankaj Tiwari on "Building Management System"

❖ Ozone rally: 16 September 2017

❖ Crystopia Energy PVT Ltd Site Visit: 18 September 2017

❖ Chapter Level Quiz at IPS Academy: on 3 jan 2018

AQUEST Quarter Final: National Level Quiz: @ 13 Jan 2018

IPS ACADEMY

SAE CHAPTER

❖ NATIONAL CART RACING CHAMPIONSHIP (NKRC SEASON IV) 2017

Alvin Abraham & Team Participated in NKRC Season IV Sep-2017 at Bhopal.

Departmental News & Updates

Students Achievements

(A) Vice Chancellor Scholarship received from Rajiv Gandhi Technical University, Bhopal (M.P.)

1. Krishnakumar Singh (IIInd Year)
2. Vishudev Mishra(II nd Year)

(B) Academic Awards

S. No.	Student Name	Name of Events	Awards
1	Yash Ghanshani	Swaranjali	First
2	Shubham Choudhary	Swaranjali	First
3	Krishna Kumar Singh	Swaranjali	First
4	Akshat Shrivastava	Swaranjali	First
5	Abhishek Tiwari	Swaranjali	Second
6	Simon Pathak	Swaranjali	Second
7	Akchat Shukla	Swaranjali	Second
8	Vishal Makhija	Swaranjali	Second

(C) Paper Published in Journals International

S. No.	Name	Topic / Title of the Paper	Name of Journal (refereed)	Year of publish (with month)
1	Mr. Manas Purohit	Analysis of hollow coil helical extension spring and the study of optimizing the weight	Int. Journal of Engineering Science & Research Technology	5/10/2017
2	Mr. Naman Gupta	Analysis of hollow coil helical extension spring and the study of optimizing the weight	Int. Journal of Engineering Science & Research Technology	5/10/2017
3	Mr. Varun Agrawal	Manufacturing and working of smart mobile case	Int. Journal of Innovative Research in science, Engineering & Technology	Jan 2018
4	Mr. Manas Purohit	Design, Analysis and weight optimization of Leaf spring for light weight vehicle	Int. research Journal of Engineering & Technology	10/01/2018
5	Mr. Naman Gupta	Design, Analysis and weight optimization of Leaf spring for light weight vehicle	Int. research Journal of Engineering & Technology	10/01/2018

(D) Workshop Attended

S. No.	Name	Date dd/mm/yyyy	Details of Workshop	Topic
1	Third Year Students	7/10/2017- 9/10/2017	Entrepreneurship Awareness Camp	Entrepreneurship

(E) SPORTS

WINNERS OF SPORTS

S. No.	Runner Up	Winner	Games
1	Varun Agrawal & team	-	Chess
2	Umesh Kumar & Team	-	Badminton

TOP SCORERS OF THE DEPARTMENT

List of Students Who Got First/Second Position (Academics) (UG)

S. No	Name of Student	Sem/Year	Position	Percentage
1	Akshat Shrivastava	VII/ IV	First	8.31
2	Vishal Makhija	VII/ IV	Second	8.15
3	Krishna Kumar Singh	V/III	First	8.85
4	Akshat Shukla	V/III	Second	8.34
5	Shubham Choudhary	IV/II	First	8.69
6	Simon Pathak	IV/II	Second	8.43
7	Yash Ghanshani	II/I	First	9.50
8	Abhishek Tiwari	II/I	Second	9.23